

Space Weather Technical Forecast

Issued on Saturday, 23 October 2021 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of Moderate class flares. Otherwise no significant activity expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low, but background flux has increased today with the arrival of a new, large sunspot region over the southeast limb (AR2887). This is one of two numbered sunspot regions on the visible disc and appears to have an Eko/Beta-gamma configuration. The other numbered region is AR2886 in the southeast quadrant, approaching the meridian. This remains a moderately sized single spot and appears to be stable with a magnetically simple configuration, carrying an Hsx/Alpha configuration. An area of plage in the northeastern quadrant has occasionally shown signs of spot development, but is still too faint to be classified at this time.

A filament eruption from the southwestern quadrant around 22/0700 UTC led to a slow partial halo CME visible in coronagraph imagery. This is currently being processed by Enlil to see if it Earth-directed. Otherwise, no Earth-directed CMEs were evident in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speeds, as measured by DSCOVR at L1, were initially at elevated levels, peaking at 501 km/s at 22/0001 UTC. An erratic, but slow downtrend in speeds has occurred to slightly elevated levels around 450km/s by the end of the period. The solar wind density was mainly at average levels, though a brief peak of 12ppcc was reported at 22/1425 UTC. Total IMF, Bt, was weak, as was the north-south Bz component, which was mainly positive. The Phi angle was been mainly negative (towards the Sun). Resultant geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 was at background levels, with no solar radiation storms observed. High energy electron flux (greater than 2 MeV) was predominantly at background levels. Associated 24-hour electron fluence was well below the Active (1e8 integrated pfu) threshold, with 1.51e6 integrated pfu recorded at 22/2400 UTC.

Four-Day Space Weather Forecast Summary

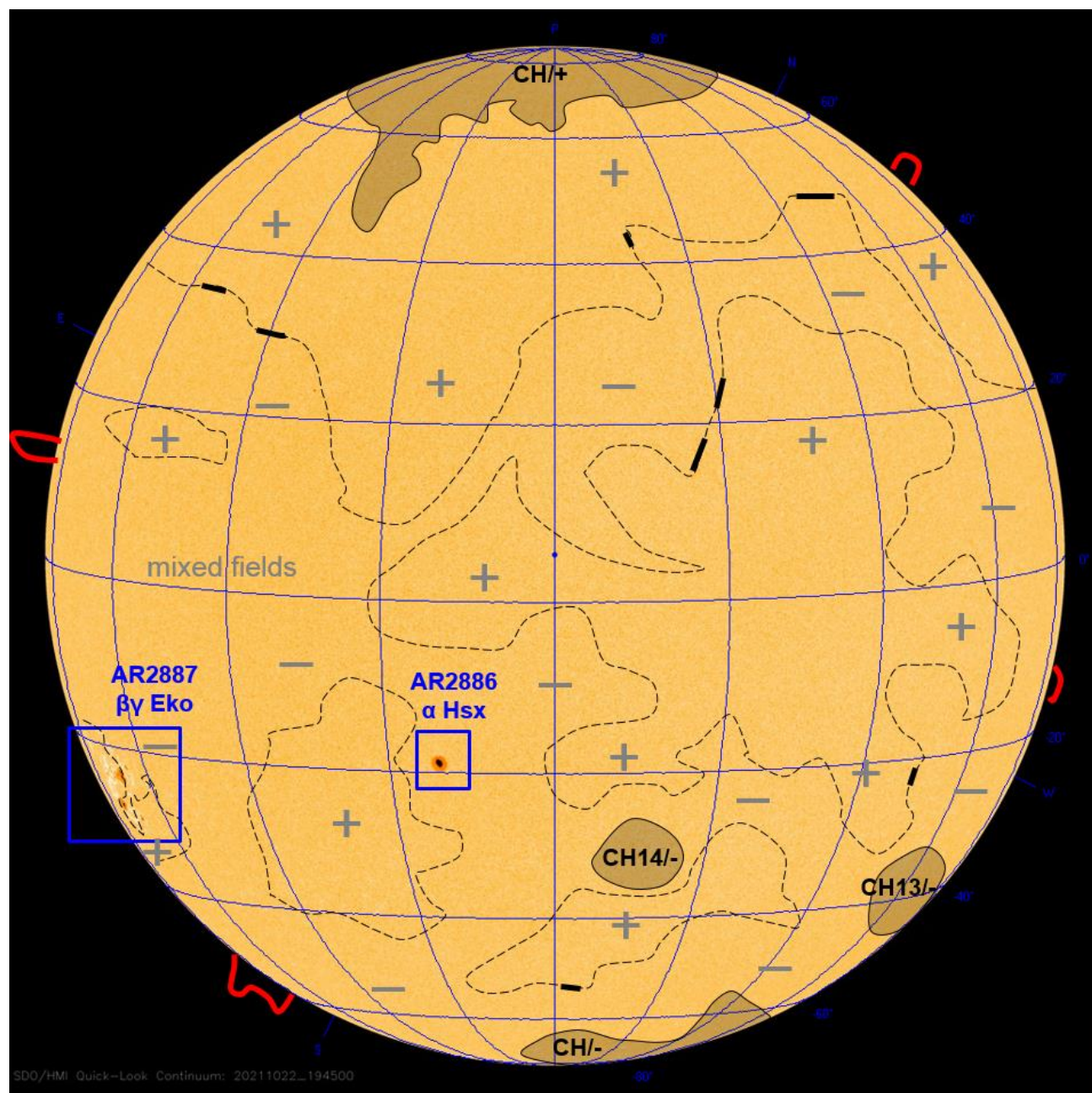
Solar Activity: Solar activity is expected to be at Low or Very low levels, but with a slight chance of M-class flares (20%). The elevated probabilities result from a large sunspot region close to the southeast limb and also a number of other groups expected to rotate onto the Earth-facing disc in the coming days.

Solar Wind / Geomagnetic Activity: The solar wind is currently slightly elevated due to connection to CH13/-, but is waning to slow-ambient levels in the coming days. No new high speed streams are expected during the period. Geomagnetic activity is very likely to be Quiet through the next four days (Kp 0-2).

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Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels, with no solar radiation storms currently expected. The high energy electron flux (greater than 2MeV) is likely to remain at or near background levels, with the 24-hour fluence corresponding to low values throughout (remaining below the Active 1e8 integrated pfu threshold).

Figure 1. Solar Analysis Valid 22/1945 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

Solar winds are currently at slightly elevated levels, around 450 km/s due to coronal hole influences related to CH13/-. The hole was slightly more advanced on the solar disc (further west) than on the previous rotation, and as such solar winds have peaked earlier than the persistence forecast would suggest, and is currently undergoing a slow decline.

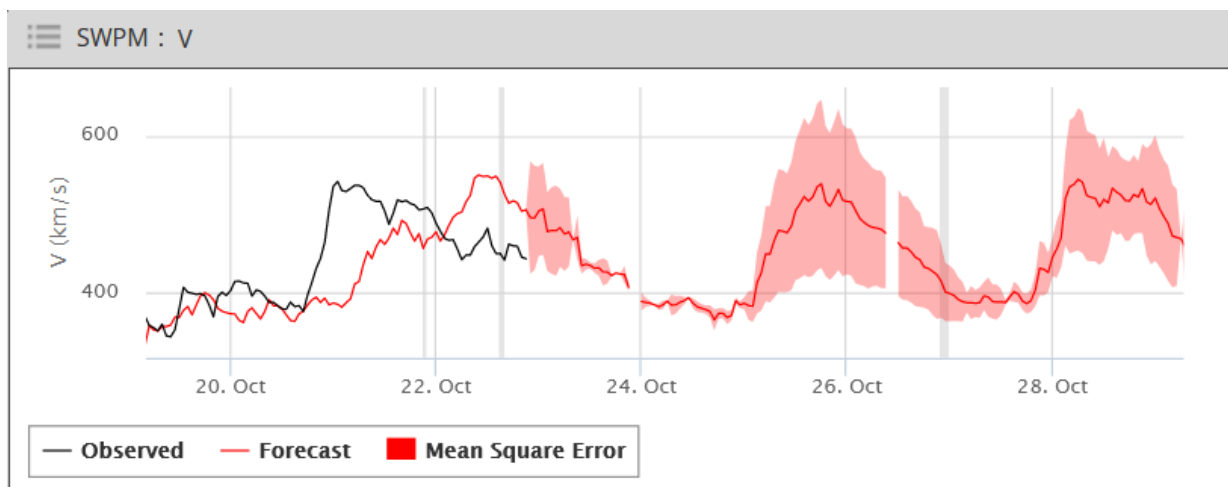
A slow CME resulting from a filament eruption around 22/0700 UTC in the southwest quadrant is currently being analysed to see if it is Earth-directed. Given the slow speed of the CME no significant geomagnetic effects are forecast. No other Earth-directed CMEs currently feature in the period.

In the absence of any high speed stream influences over the coming days the solar wind is very likely to reach background levels and stay at ambient speeds through the rest of the period. Geomagnetic activity is currently expected to be Quiet (Kp 0-2) throughout.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections – Nil.

Figure 2: MOSWOC SWPM. Earlier drop-off in solar winds presently observed due to differing position of CH13/- compared to previous rotation. Increase on the 25th also not expected as next CH much less developed and further east than 27-days ago.



Radio Blackouts - X-Ray Flares:

Solar activity is expected to be at Low or Very Low levels through the period, but with a slight chance of Moderate activity.

There are two numbered active region on the visible disc at present. AR2886 (Hsx/Alpha), located in the southeast quadrant close to the meridian remains in a stable configuration with no notable flares observed during the past 24 hours.

The new region near the southeast limb has now been numbered AR2887 and shows multiple sunspots. The two largest spots in the group, of opposite polarity, contain large asymmetric penumbra. There are few, if any spots between the leader and follower portions of the group. A tentative classification of Eko/Beta-gamma is given to this region, though assessment will be easier once it has moved into better view as there is a significant foreshortening effect on this area at present.

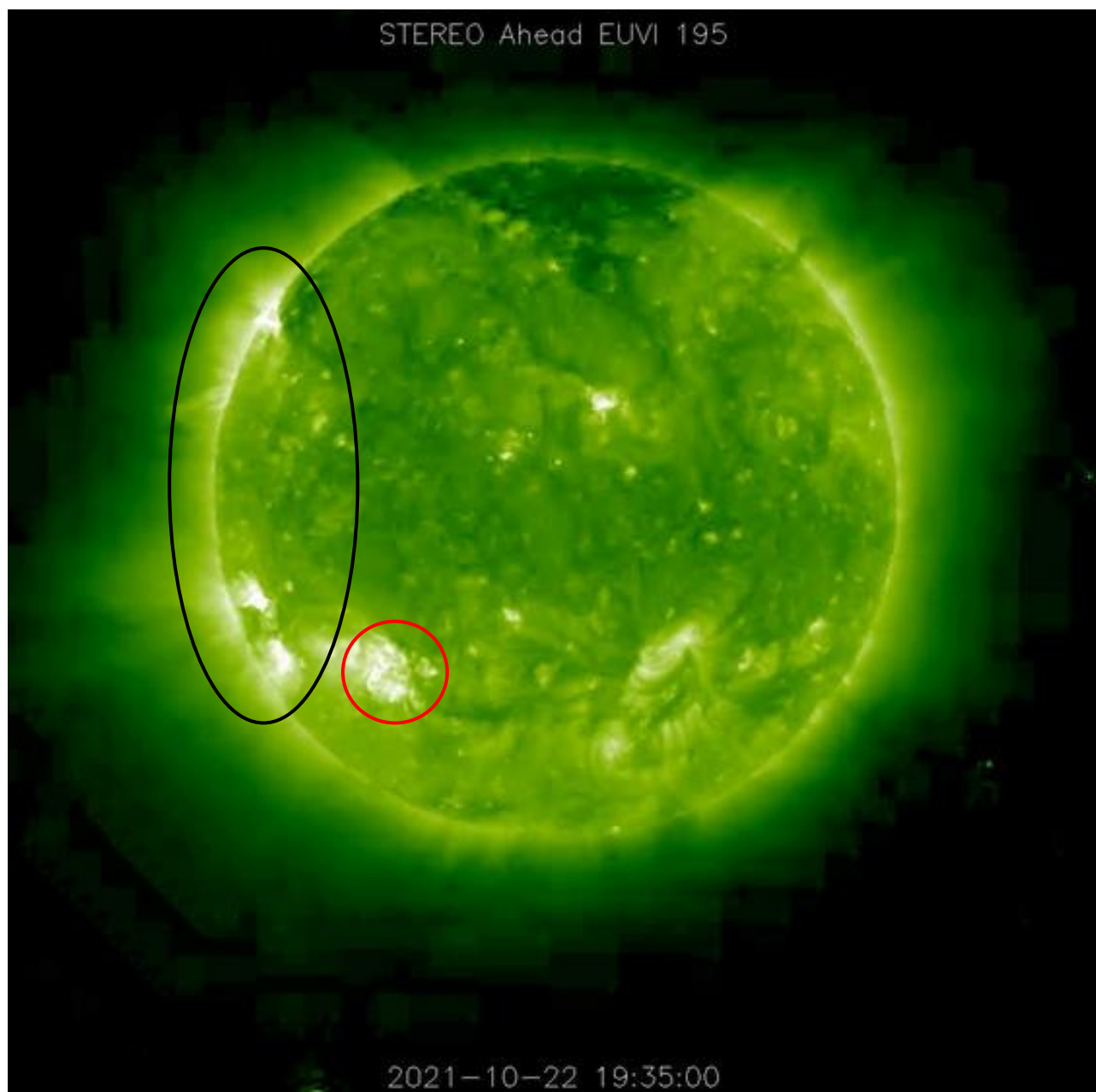
An area of plage in the northeastern quadrant may be attempting to develop a simple Axx/Alpha or Bxo/Beta spot(s), though is not included at this time as a sunspot region.

A number of bright flux regions are evident close to the eastern limb STEREO EUVI 195 imagery in both the north and southern hemispheres. These regions are expected to rotate onto the earth-facing disc in the coming days and may present an increased risk of significant flaring.

The elevated probabilities of M-class flares represents the risk from AR2887 and the new regions soon to rotate onto the earth-facing disc in the coming days.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: STEREO A EUVI 195 imagery at 22/1935 UTC. AR2887 is circled in red and new regions of interest highlighted in black.



Solar Radiation Storms - (High Energy Protons):

With no significant sunspots in geoeffective positions on the Sun, solar radiation storms are currently not expected.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	1	1	1	1
Very Active	$\geq \text{S3}^*$	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)

High Energy Electrons Event ($\geq 2 \text{ MeV}$):

The high energy (greater than 2 MeV) electron flux is currently at very low background levels. The influence of the current high speed stream, from CH13/-, has not been sufficient enough to raise electron flux counts within the radiation belts, probably due to the wrong phi-angle polarity for the time of year (negative is less efficient at disrupting our magnetosphere in the Boreal Autumn). Flux levels rose on the previous rotation, but not above the High (1000 pfu) level, and perhaps there was some preconditioning going on which isn't evident now.

The corresponding electron fluence is currently well below the Active ($1\text{e}8$ integrated pfu) threshold on a steady trend. The REFM model is currently indicating a rising trend in electron fluence over the coming days, probably in response to persistence from the previous rotation. As discussed this is likely overdone and expected to remain well below the threshold through the period.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV} \geq 1 \times 10^8$	No	1	5	5	1
Very Active	$\geq 2 \text{ MeV} \geq 1 \times 10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM output.

